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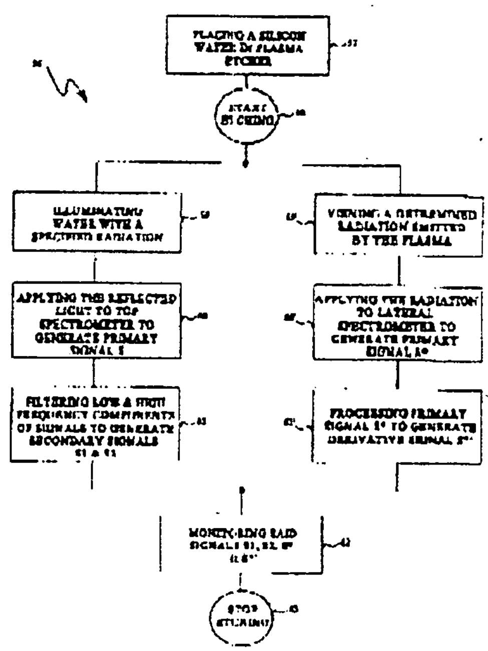
(54) Method for real-time in-situ monitoring of a trench formation process

(57) In the manufacturing of 16 Mbit DRAM chips, the deep trench formation process in a silicon wafer by plasma etching is a very critical step when the etching gas includes O2 (e.g. in a standard HBr-NF3 chemistry). As a result, the monitoring of the trench formation process and thus the etch end point determination is quite difficult. The disclosed monitoring method is based on zero order interferometry. The wafer is placed in a plasma etcher (57) and a plasma is created (58). A large area of the wafer is illuminated (59) through a view port by a radiation of a specified wavelength at a normal angle of incidence. The reflected light is collected then applied (60) to a spectrometer to generate a primary signal S of the interferometric type. Next, this signal is applied in parallel to two filters (61). A low-pass filter produces a first secondary signal S1 that contains data related to the deposition rate and the redeposited layer thickness. A band-pass filter produces a second secondary signal S2 that contains data related to the trench etch rate and depth. The band-pass filter is centered around the fundamental frequency of the interferometry phenomenon. These filtered signals are monitored (62) as standard and the trench formation parameters such as the SiO2 redeposited layer thickness and the trench depth are accurately measured in real time to allow an accurate determination of the etch end point (63). It is worthwhile to have the optical emission of the plasma viewed by another spectrometer to generate a second primary signal S* that is used to validate the parameter measurements (59', 60', 61').



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